Patterns of Inheritance

Process and Procedures

Date

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3. Record the color of your beads. Are they homozygous or heterozygous?

6. Record the colors of the two beads. Are they homozygous or heterozygous?

7a. To which thumb type did your first bead combination correspond?

7b. To which thumb type did your partner's first bead combination correspond?

7c. To which thumb type did the new offspring combination correspond?

9a. Describe any patterns of bead colors that relate to hitchhiker's thumb.

9b. Describe any patterns of bead colors that relate to straight thumb.

9c. Did one bead color have a greater influence in determining hitchhiker's thumb than the other bead? If so, which one?

11a. In steps 2-9, were the beads a model for phenotype or genotype?

11b. Label the combinations and traits in steps 3, 6 and 7 as phenotype or genotype.

12. Write a paragraph that describes the inheritance of hitchhiker's thumb using the terms *dominant*, *recessive*, *phenotype*, *genotype* and *alleles*.

14a. Record the genotype of each parent.

15. Complete the Punnett square.

16. Write the phenotype for each possible offspring under the genotype in each square.

17a. What is the probability that an offspring will have a heterozygous genotype?

17b. What is the probability that an offspring will have a hitchhiker's thumb phenotype?

17c. If the couple has eight children, how many of them are likely to have a straight thumb?

17d. Can you say with certainty how many children the couple will have with straight thumbs? Explain.

19. Fill in a Venn diagram for Huntington's disease and cystic fibrosis.

Patterns of Inheritance

Phenotype and Genotype

Date

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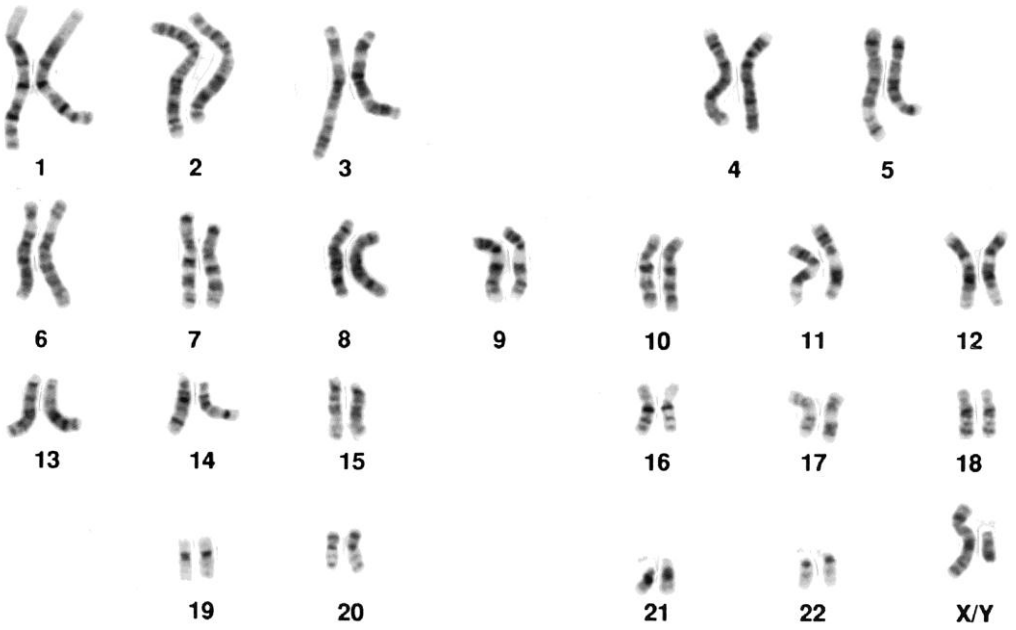
Genetics the study of traits passed down from parents to offspring

Karyotype a display of an organism's chromosomes

Arranged by size and shape



Trait a characteristic of an organism

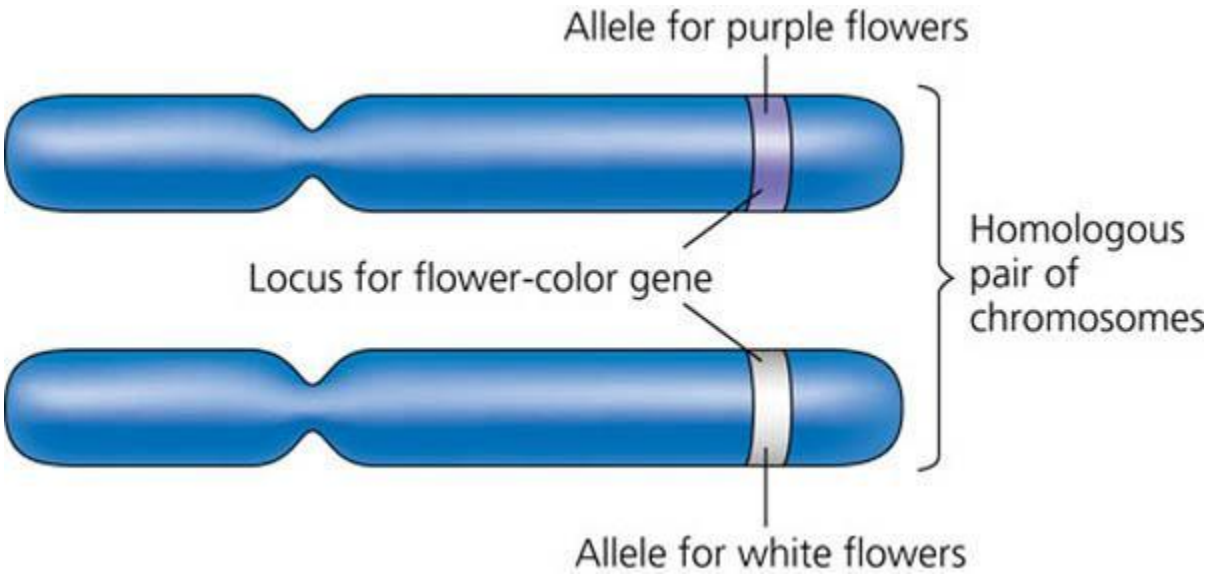
They are inherited from your parents

Examples: eye color, height, blood type

Gene — a section of DNA that controls a trait

Organisms have at least two genes for most traits

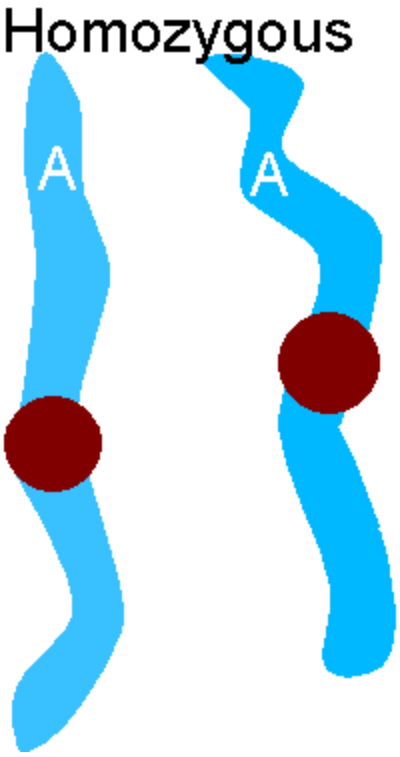
Allele — different version of the same gene



Homozygous — when both alleles of a pair are alike

Homo = same

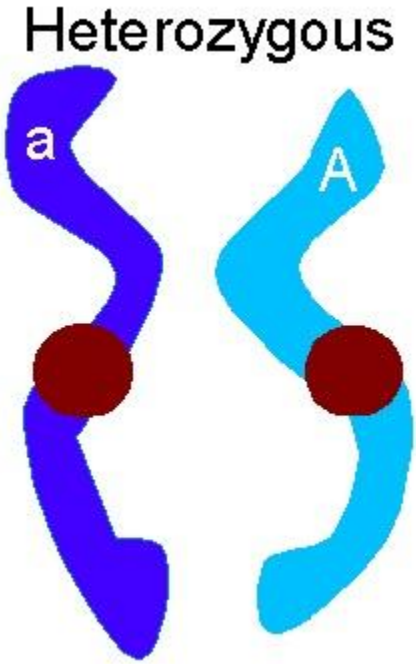
Examples:
BB = brown eyes
bb = blue eyes
TT = tall
tt = short



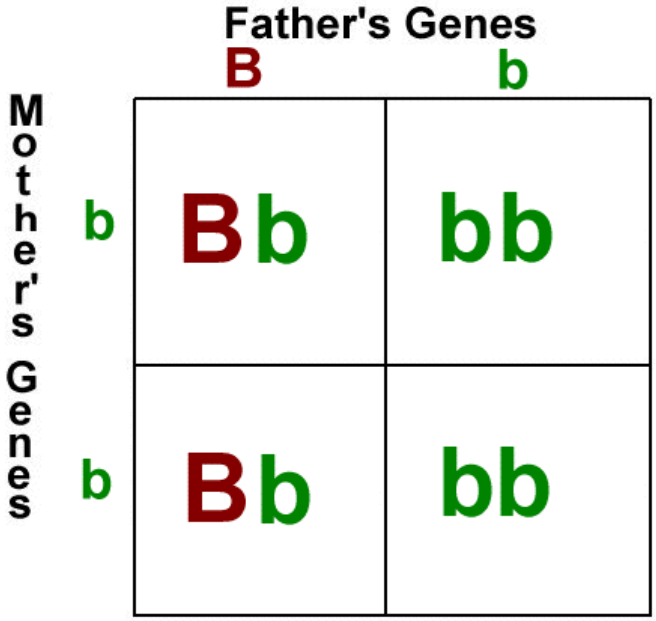
Heterozygous when the alleles of a pair are different

Hetero = different

Examples: Bb
Tt



Dominant	describes a stronger gene whose trait always shows itself
Dominant trait	represented by an uppercase letter
	Homozygous dominant •BB (brown eyes) •TT (tall)
	Heterozygous dominant •Bb (brown eyes) •Tt (tall)
Recessive	a gene that shows itself only when the dominant allele is not present
	The "hidden" gene
Recessive trait	Represented by a lowercase letter
	Homozygous recessive •bb (blue eyes) •tt (short)
Punnett square	a chart used to show possible gene combinations and the probability of each combination occurring



Phenotype — an organism's physical appearance

- hair color
- eye color
- height
- nose shape

Genotype — an organism's genetic makeup

- Tt
- RR
- bb

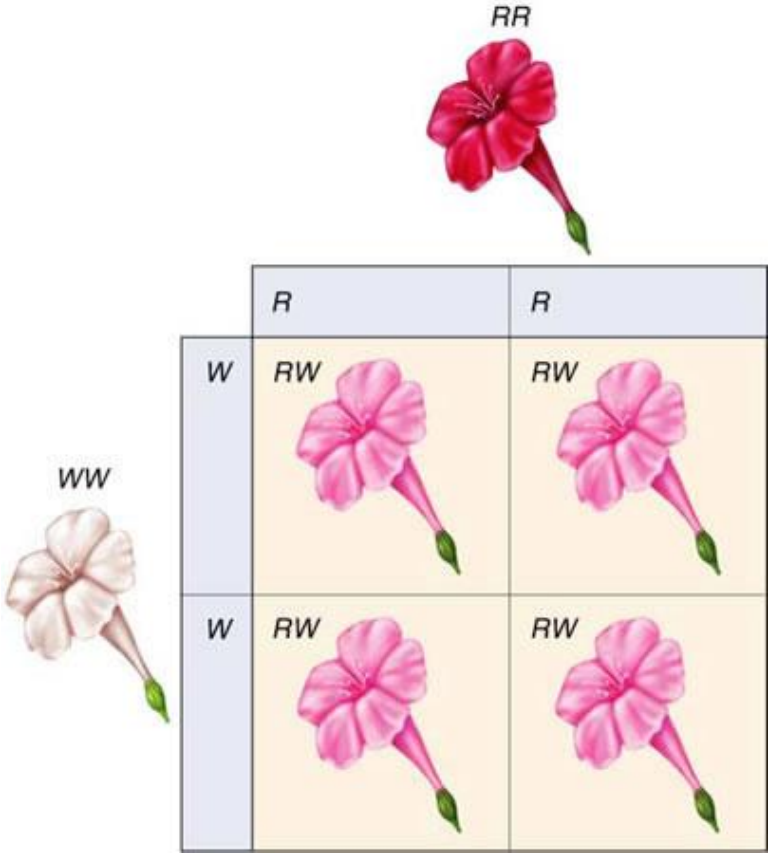
Incomplete dominance — alleles from both parents are blended

Example: four o'clock flowers

RR = homozygous red
WW = homozygous white

Neither allele is completely dominant over the other

RW = pink



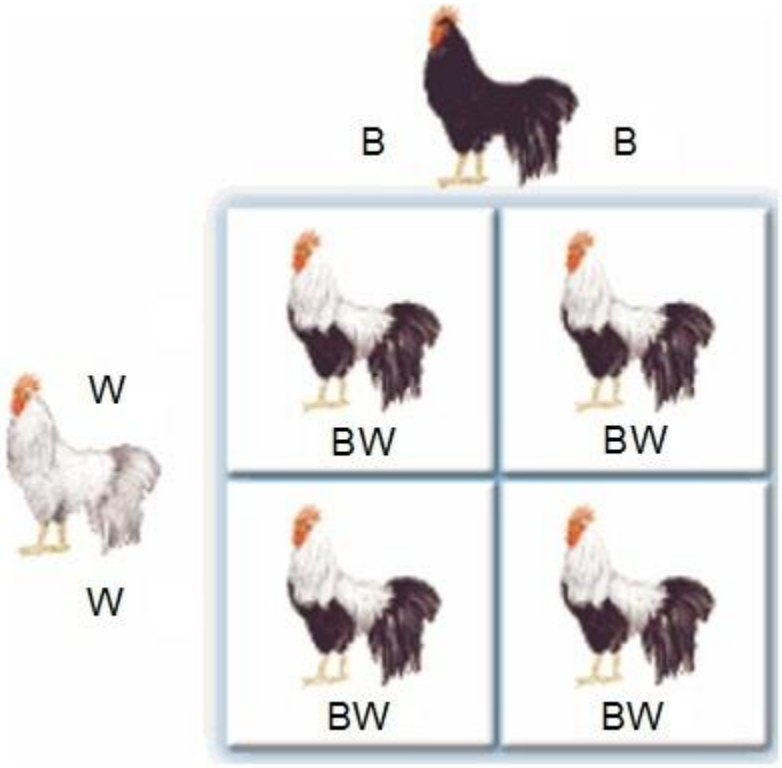
Codominance both alleles of a gene are expressed

Neither allele is dominant over the other

Example: Erminette chickens

BB = homozygous black
WW = homozygous white

BW = black and white feathers



Heterozygous cross

25% homozygous dominant
50% heterozygous
25% homozygous recessive

<u>Always</u> 1:2:1 ratio

Dominant and Recessive
(T = Tall; t = short)
Cross: Tt x Tt

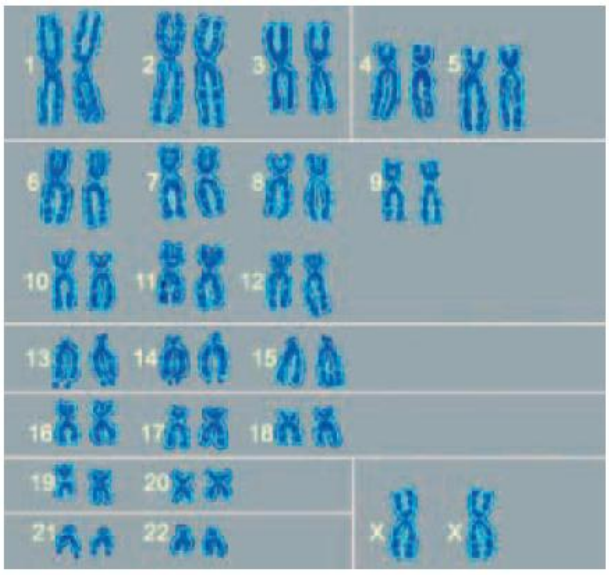
	T	t
T	TT	Tt
t	Tt	tt

Genotypic ratio: 1 : 2 : 1 (TT=25% Tt=50% tt=25%)

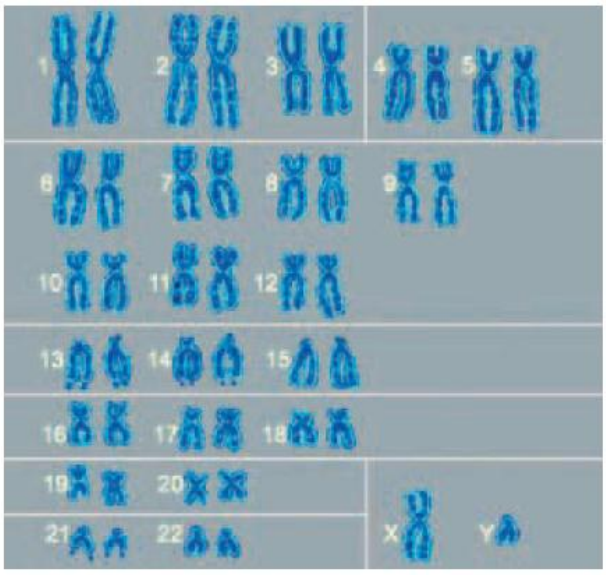
Phenotypic ratio: 3 : 1 (Tall=75% Short=25%)

Sex determination gametes pair up during Meiosis I

Female genotype = XX
Male genotype = XY



(a) Female karyotype



(b) Male karyotype

Dihybrid cross — diagram that predicts genetic outcome when crossing two characteristics

Homozygous × homozygous

Example: pea plants

Seed shape:
R = round (dominant)
r = recessive (wrinkled)

Seed color:
Y = yellow (dominant)
y = green (recessive)

All offspring of the first generation (F_1) will be heterozygous for both traits (RrYy)

They will have round, yellow seed phenotypes

rryy

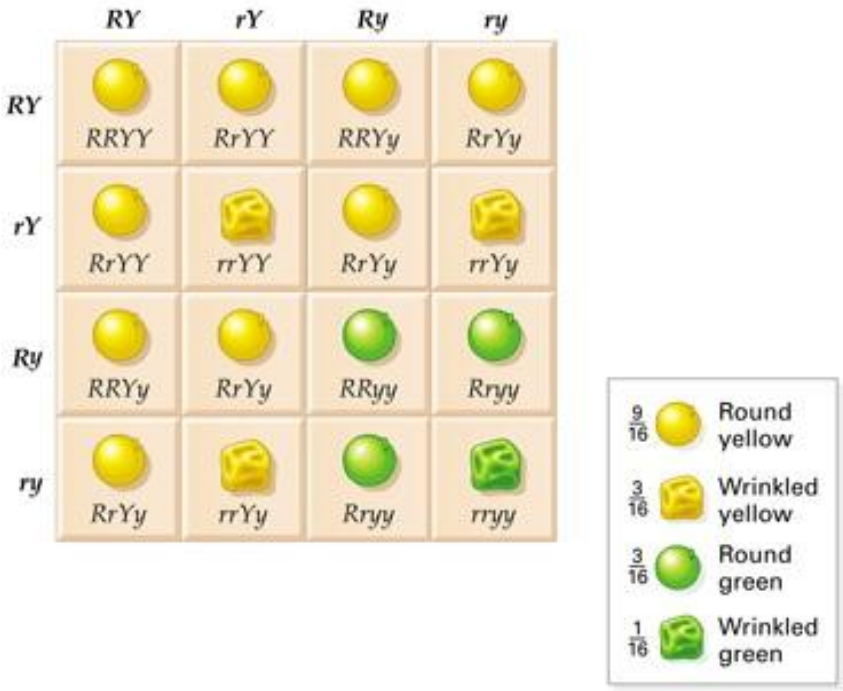
RRYY

	ry	ry	ry	ry
RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy

Heterozygous × heterozygous

cross of the first generation (F_1)

RrYy × RrYy



9/16 = round/yellow
3/16 = wrinkled/yellow
3/16 = round/green
1/16 = wrinkled/green

<u>Always</u> 9:3:3:1 ratio

Patterns of Inheritance

Case Studies of Two Genetic Disorders

Date

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Huntington's disease

a dominant genetic disorder that causes a breakdown of brain cells

Symptoms:
- uncontrollable movements
- changes in behavior
- difficulty swallowing and speaking
- confusion and memory loss

A heterozygous (Hh) individual develops the disease

A homozygous (hh) individual does not develop the disease

Cystic fibrosis

a recessive genetic disease that causes chronic respiratory and digestive problems:

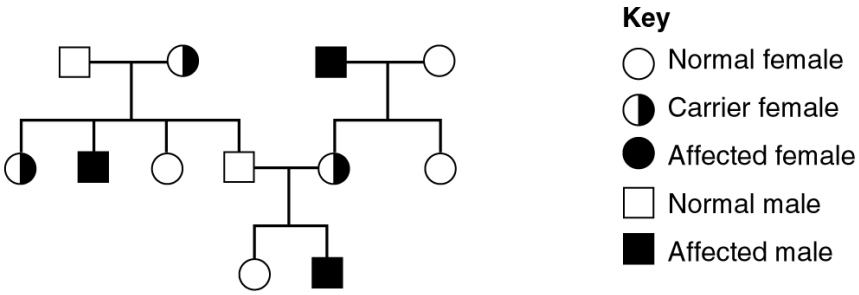
- thicker and stickier mucus clogs the lungs
- as a result, bacteria there cause infections more easily
- caused by a single gene

A homozygous recessive (ff) individual develops the disease

Carrier — individual that is heterozygous for a recessive trait but does not show the trait

FF = normal genotype
Ff = carrier
ff = cystic fibrosis

Pedigree — a diagram that shows the inheritance of certain traits over several generations



Sex-linked traits — traits that are controlled by the sex chromosomes

Examples
- hemophilia
- color blindness
- male pattern baldness

Sex-linked traits — found more often in men than women

Most sex-linked traits are carried on the X chromosome (larger, carries more genes)

Males only have one copy of the X chromosome

If they have just one copy of the allele for a disorder, they are affected by that disorder

Females that have one copy of the allele for the disorder will only be carriers